

CLAIMS

1. A wavelength separation device comprising a plurality of optical heterostructures, wherein:

said optical heterostructures are characterized by distinct transmission bandwidths;

each of said plurality of optical heterostructures comprises a first bandgap region and a second bandgap region defined in a matrix of said optical heterostructure;

said first bandgap region defines a first optical bandgap of said optical heterostructure;

said second bandgap region defines a second optical bandgap of said optical heterostructure; and

said first optical bandgap of said optical heterostructure is centered at a different wavelength than said second optical bandgap of said optical heterostructure such that one of said transmission bandwidths is defined between said first and second optical bandgaps.

2. A wavelength separation device comprising a plurality of optical heterostructures characterized by distinct transmission bandwidths, wherein:

a first bandgap region and a second bandgap region of a first optical heterostructure are defined in a matrix of said first optical heterostructure;

said first bandgap region of said first optical heterostructure defines a first optical bandgap of said first optical heterostructure;

said second bandgap region of said first optical heterostructure defines a second optical bandgap of said first optical heterostructure;

said first optical bandgap of said first optical heterostructure is centered at a different wavelength than said second optical bandgap of said first optical heterostructure such that one of said distinct transmission bandwidths is defined between said first and second optical bandgaps of said first optical heterostructure;

a first bandgap region and a second bandgap region of an additional optical heterostructure are defined in a matrix of said additional optical heterostructure;

said first bandgap region of said additional optical heterostructure defines a first optical bandgap of said additional optical heterostructure;

said second bandgap region of said additional optical heterostructure defines a second optical bandgap of said additional optical heterostructure; and

5 said first optical bandgap of said additional optical heterostructure is centered at a different wavelength than said second optical bandgap of said additional optical heterostructure such that an additional one of said distinct transmission bandwidths is defined between said first and second optical bandgaps of said additional optical heterostructure.

10 3. A wavelength separation device as claimed in claim 2 wherein said matrix of said first optical heterostructure is integral with said matrix of said additional optical heterostructure.

15 4. A wavelength separation device as claimed in claim 2 wherein said first optical heterostructure and second additional optical heterostructure are separated by a zero bandwidth region.

20 5. A wavelength separation device as claimed in claim 2 wherein:
 said wavelength separation device comprises an input face and an output face; and
 said first and said additional optical heterostructure are arranged between said input face and said output face.

25 6. A wavelength separation device as claimed in claim 5 wherein:
 said first optical heterostructure defines a first transmission bandwidth output at said output face; and
 said additional optical heterostructure defines an additional transmission bandwidth output at said output face.

30 7. A wavelength separation device as claimed in claim 6 wherein:
 said first optical heterostructure and second additional optical heterostructure are separated by a zero bandwidth region;

said zero bandwidth region defines a zero transmission bandwidth output at said output face; and

said first and said additional transmission bandwidth outputs are separated by said zero transmission bandwidth output.

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8. A wavelength separation device as claimed in claim 6 wherein said first and said additional transmission bandwidth outputs are coupled to respective first and additional waveguides.

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9. A wavelength separation device as claimed in claim 2 wherein at least one of said first and second bandgap regions of said first and additional optical heterostructures is characterized by a periodic arrangement of inclusions in said matrix.

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10. A wavelength separation device as claimed in claim 9 wherein said inclusions have an index of refraction substantially different than an index of refraction of said matrix.

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11. A wavelength separation device as claimed in claim 2 wherein at least one of said first and second bandgap regions of each of said first and additional optical heterostructures is characterized by a periodic arrangement of inclusions in said matrix.

12. A wavelength separation device as claimed in claim 2 wherein all of said first and second bandgap regions of said first and additional optical heterostructures are characterized by a periodic arrangement of inclusions in said matrix.

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13. A wavelength separation device as claimed in claim 2 wherein at least one of said first and second bandgap regions of said first and additional optical heterostructures is characterized by an absence of a periodic arrangement of inclusions in said matrix.

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14. A wavelength separation device as claimed in claim 2 wherein at least one of said first and second bandgap regions of each of said first and additional optical heterostructures is characterized by an absence of a periodic arrangement of inclusions in said matrix.

15. A wavelength separation device as claimed in claim 2 wherein a distinct transmission bandwidth of at least one of said optical heterostructures is attributable to a magnitude of a spacing between band gap regions of said second type in said optical heterostructure.

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16. A wavelength separation device as claimed in claim 15 wherein said spacing between band gap regions of said second type is created by interposition of a band gap region of said first type there between.

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17. A wavelength separation device as claimed in claim 2 wherein distinct transmission bandwidths of said first optical heterostructure and said additional optical heterostructure are attributable to a variance in respective spacing magnitudes L_1 , L_2 between band gap regions of said second type in said first optical heterostructure and band gap regions of said second type in said additional optical heterostructure.

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18. A wavelength separation device as claimed in claim 17 wherein said respective spacing magnitudes L_1 , L_2 vary by less than about 1 %.

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19. A wavelength separation device as claimed in claim 17 wherein said respective spacing magnitudes L_1 , L_2 vary by about 1% to about 10%.

20. A wavelength separation device as claimed in claim 17 wherein said respective spacing magnitudes L_1 , L_2 are between about $0.5\mu\text{m}$ and about $5\mu\text{m}$.

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21. A wavelength separation device as claimed in claim 2 wherein:

said first bandgap region of at least one of said optical heterostructures is characterized by a periodic arrangement of first inclusions in said matrix; and

said second bandgap region of at least one of said optical heterostructures is characterized by a periodic arrangement of second inclusions in said matrix.

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22. A wavelength separation device as claimed in claim 21 wherein a distinct transmission bandwidth of at least one of said optical heterostructures is attributable to variations in said first and second inclusions of said optical heterostructure.

5 23. A wavelength separation device as claimed in claim 22 wherein said variations are selected from differences in respective sizes of said first and second inclusions, differences in respective periodicities of said first and second inclusions, differences in respective compositions of said first and second inclusions, and combinations thereof.

10 24. A wavelength separation device as claimed in claim 2 wherein:
said first bandgap region of said first optical heterostructures is characterized by a periodic arrangement of first inclusions in said matrix; and
said second bandgap region of said additional optical heterostructures is characterized by a periodic arrangement of second inclusions in said matrix.

15 25. A wavelength separation device as claimed in claim 24 wherein distinct transmission bandwidths of both said first optical heterostructure and said additional optical heterostructure are attributable to variations in said first and second inclusions of said optical heterostructures.

20 26. A wavelength separation device as claimed in claim 2 wherein said first and second bandgap regions of at least one of said optical heterostructures alternate in succession along a primary dimension of optical propagation of said wavelength separation device to define a succession including at least one bandgap region of said first type interposed between a pair of bandgap regions of said second type.

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